SET-1

Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination – April, 2017

Program/course: B Tech PSE
Subject: Energy Conservation and Audit
Code : PSEG-441
No. of page/s: 2

Semester : VIII
Max. Marks : 100
Duration : 3 Hrs

SECTION-A

All questions carry equal marks (5*4)

Q1. Discuss the indirect method for calculating boiler efficiency. **(4)**
Q2. Discuss various energy saving opportunities available for compressed air system. **(4)**
Q3. Discuss in detail about flash steam recovery from steam condensate. **(4)**
Q4. Explain Preliminary Energy Audit with the help of an example. **(4)**
Q5. Explain with sketch how to determine the LMTD of counter flow and parallel flow heat exchanger. **(4)**

SECTION-B

All questions carry equal marks (4*10)

Q6. Explain various energy saving opportunities available in lighting system and also explain ILER method for designing the interior lighting system. **(10)**

Q7. In an automobile industry one compressor of rated capacity of 1000 cfm is operated to evaluate leakage quantity in the plant during a holiday when no equipment was using compressed air. FAD test was also carried out before conducting leakage test and found that the compressor is delivering output of 90% of rated capacity.

The observations on leakage test are:

a) Compressor was on load for 08 minutes **(b)** Compressor was unloaded for 48 minutes

c) Compressor was consuming 144 kW

Evaluate following

(a) Free air delivery **(b)** Specific power consumption **(c)** % leakage in compressed air system

(d) Leakage quantity **(e)** Power lost due to leakage **(10)**

Q8. In a double pipe heat exchanger hot fluid is entering at 220°C and leaving at 115°C. Cold fluid enters at 10°C and leaves at 75°C. Mass flow rate of hot fluid 100 kg/hr, cp of hot fluid 1.1 kcal/kg°C, Cp of cold fluid 0.95kcal/kg°C. Calculate LMTD

i) If the flow is parallel

ii) If the flow is counter current.

iii) Find the mass flow rate of cold fluid if the heat loss during the exchange is 5% **(10)**

Q9. Two main areas of an industrial plant have the following lighting systems:

Area A: 50 x 400W High Pressure Sodium (HPSV) single lamp luminaires.

Area B: 35 x 400W Mercury Vapour (HPMV) single lamp luminaires.

In Area A and Area B, the measured illuminance during daylight hours (12 hours) without artificial light was found to be adequate. In Area B it was noted that 8 of the MV fixtures are redundant. Plant Operating Hours: 24 hours per day, 365 days per year. Electricity Energy costs: Rs 3.00/kWh. Calculate the annual potential energy cost savings from switching off unnecessary lights and from disconnecting redundant luminaires? **(10)**

SECTION-C

Note: Attempt all questions **(2*20)**

Q.10 A 4-pole 415 V 3-phase, 50 Hz induction motor runs at 1440 RPM at .88 pf lagging and delivers 10.817 kW. The stator loss is 1060 W, and friction & windage losses are 375 W.

Calculate (A) Slip (B) Rotor Copper loss (C) Line current (D) Efficiency **(20)**

Q11. (a) Explain with the help of sketch Thermodynamic steam trap and Thermostatic steam trap.

(b) Explain the term Energy Policy by giving relevant example.

OR

(a) Discuss Life cycle cost analysis of Energy Efficient Motors in comparison with standard motors,

(b) Discuss how Energy Pricing is done for coal, electricity and Oil in India. **(20)**

SET-2

Roll No: ----------

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SECTION-A

All questions carry equal marks (5*4)

Q1. "Industry would get benefits from energy efficiency programs"- Discuss the points favoring the statement. **(4)**

Q2. Discuss the Powers and Functions of Bureau of Energy Efficiency as per the ECT-2001. **(4)**

Q3. Discuss in brief various energy saving opportunities available in a Cooling Towers. **(4)**

Q4. Explain the layout of compressed air system and its components **(4)**

Q5. The ILER of a room is 0.7. If the lighting load is 990 W, calculate the annual energy Wastage. Assume the room light is ON for 8 hours/day for 300 days **(4)**

SECTION-B

All questions carry equal marks (4*10)

Q6. Elaborate the methodology adopted by the industries to reduce their electricity bill giving example. **(10)**

Q7. In a process plant a coal fired boiler of 78% efficiency is proposed to be replaced with paddy husk fired boiler of 68% efficiency. Calculate the cost savings for changing over to paddy husk.

Calorific value of coal = 4800 kcal/ kg
Cost of coal = Rs. 2500 / MT
GCV of paddy husk (Kcal/kg) = 3568
Cost of Paddy Husk = Rs. 1100 / MT
Quantity of steam requirement = 15 TPH
Enthalpy of steam = 770 kCal / kg
Enthalpy of feed water = 120 kCal / kg
Annual operating hours of boiler = 8000 hrs **(10)**

Q8. In a chemical industry reciprocating compressor of two stages was tested for free air delivery. The test details are as follow:

a) Receive capacity : 5 m3 b) Initial pressure : 1 kg/cm2 g c) Final pressure : 7.0 kg/cm2 g
d) Connecting pipe volume and moisture separator volume : 0.5 m3
e) Compressor pump up time: 5 minutes
f) Motor power consumption: 37 kW
g) Temp. of air in the receiver : 36 °C
h) Ambient air temperature: 30 °C

Evaluate the FAD (free air delivery), and specific power consumption. **(10)**

Q9. From the data given below

Rated Power: 34kW **Voltage:** 415V **Current:** 57A **Speed:** 1475rpm

No Load Test Data:

Voltage- 415V **Current:** 16.1A **Stator Resistance at 30°C:** 0.264Ohms

No Load Power: 1063.74Watts

Calculate

(a) Iron plus friction and Windage Loss

(b) Stator Resistance at 120°C

(c) Stator Copper Losses at operating temrature of resistance at 120°C.

(d) Full load speed and rotor input assuming rotor losses are slip times rotor input.

(e) Motor input assuming that stray losses are 0.5% of the motor rated power.

(f) Motor full load efficiency and full load power factor. **(10)**

SECTION-C

All questions carry equal marks **(2*20)**

Q10.(a) From the parameters given below, calculate the size of the impeller which is geometrically similar size. The existing impeller diameter is of 380 mm **(10)**

Parameter	Unit	Rated	Required
Flow	m^3/h	310	280
Head	M	45	43.5
Power	kW	55	46

(b) Discuss in detail the methodology of Heat Exchanger Performance Assessment**.** **(10)**

Q11. In an energy audit study of a cement plants following measurement were noted.

Pump ID	**Measured flow, m^3/h**	**Measured , kW**	**Operating head, m**	**Rated flow, m^3/h**	**Rated head, m**
P1	12.31	42	357.o	15	380
P2	13.14	35	357.0	15	380
P3	21.60	55	362.25	25	380

Note: Motor efficiency is considered as 85%

Evaluate the operating efficiency of the pumps and suitably replace the pumps with new pumps of efficiency 75%. What would be the annual reduction in energy consumption after implementation of the above measure?

OR

Discuss the methodology of Energy Audit in Thermal Power Plant. Develop various formats used to record data for analysis. **(20)**